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SOLAR/1050-79/02

# Monthly Performance Report

BOND CONSTRUCTION

FEBRUARY 1979



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## U.S. Department of Energy

National Solar Heating and  
Cooling Demonstration Program

National Solar Data Program

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## MONTHLY PERFORMANCE REPORT

### BOND CONSTRUCTION

FEBRUARY 1979

#### I. SYSTEM DESCRIPTION

The Bond Construction site is a single-family residence in Gladstone, Missouri. The home has approximately 1400 square feet of conditioned space. Solar energy is used for space heating the home and preheating domestic hot water (DHW). The solar energy system has an array of flat-plate collectors with a gross area of 465 square feet. The array faces south at an angle of 37 degrees to the horizontal. A propylene glycol solution is the transfer medium that delivers solar energy from the collector array to an external heat exchanger. Water is the transfer medium that delivers solar energy from the external heat exchanger to storage and from storage to the hot water load and liquid-to-air heat exchanger in the furnace. Air is the transfer medium that delivers solar energy to the space heating load. Solar energy is stored in the basement in an 800-gallon steel storage tank with walls approximately 1/4-inch thick. The storage tank has 4-inch polyurethane insulation on the bottom and 8-inch fiberglass insulation on the top and sides. Preheated city water is stored in an 82-gallon DHW tank. When solar energy is insufficient to satisfy the space heating load, a gas furnace provides auxiliary energy for space heating. Similarly, an electrical immersion heater in the DHW tank provides auxiliary energy for heating the supply water. Solar energy is transferred from the storage tank to the hot-air heating system by a liquid-to-air heat exchanger contained in the furnace ductwork; solar energy is transferred from the storage tank to the DHW tank by an annular heat exchanger jacket around the hot water tank. The house also contains a fireplace with an integral fan; the fireplace is only instrumented for monitoring fan power consumption. The system, shown schematically in Figure 1, has 5 modes of solar operation.

Mode 1 - Collector-to-Storage: This mode activates when there is a temperature difference of 20°F between a control sensor located at the collector and a control sensor located inside the storage tank (near the bottom). At this time the controller turns on both the collector and storage circuit pumps (P1 and P2, respectively). Solar energy is transferred from the collector to the storage tank by an external heat exchanger. Both pumps continue to operate until the temperature difference is less than 5°F; the controller then turns both pumps off.

Mode 2 - Storage-to-Space Heating: This mode activates when the room temperature drops to the setting on the house thermostat. At this point, this mode is initiated if the storage temperature, measured by a control sensor inside the tank (near the top), is higher than 95°F. If so, the furnace circuit pump (P3) turns on and hot water circulates from the storage tank through a liquid-to-air heat exchanger in the furnace. At the same time the furnace fan turns on, forcing air past the heat exchanger, thereby transferring the solar energy to the heating load. If the room temperature drops an additional increment (set point), the auxiliary gas burner turns on to provide

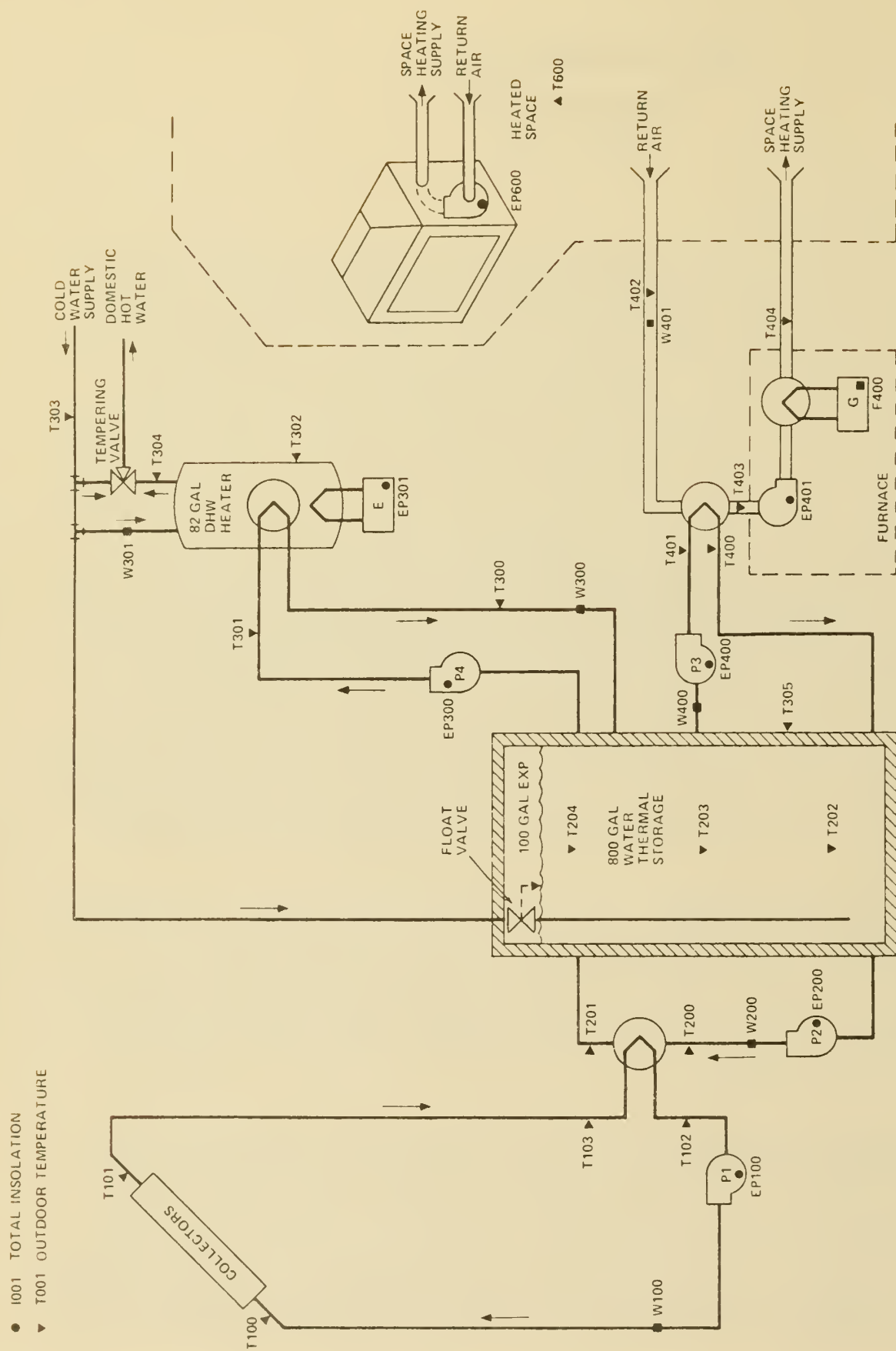


Figure 1. BOND CONSTRUCTION CO. SOLAR ENERGY SYSTEM SCHEMATIC

auxiliary energy to the heating load. If storage temperature falls to 90°F while in this mode, the mode terminates. However, the fan and gas furnace continue to supply energy until the thermostat demand is satisfied. If the storage temperature is below 95°F when the room thermostat calls for heat, this mode does not activate; auxiliary energy is then provided by the gas furnace. The pump, fan and burner (if on) are turned off when the room temperature exceeds the thermostat setting.

Mode 3 - Storage-to-DHW: This mode activates when there is a temperature difference of 10°F between the control sensor located inside the storage tank (near the top) and the control sensor located in the hot water tank (near the middle). This mode terminates when the temperature difference drops to 3°F. When this mode activates, pump P4 circulates hot water from the storage tank through an annular jacket surrounding the hot water tank; energy is thereby transferred to the water in the hot water tank. The electric immersion heater in the hot water tank turns on to provide auxiliary energy to the DHW if the temperature in the hot water tank drops below its thermostat setting.

Mode 4 - Elimination of Excess Heat in Summer: This mode activates when the storage tank temperature, as determined by an aquastat located in the tank, exceeds 180°F. At this time the collector and storage circuit pumps (P1 and P2, respectively) are activated, thereby transferring energy from the storage tank to the collector by way of the external heat exchanger. This energy is then radiated from the collector to the atmosphere. This mode continues until the storage temperature drops below 180°F.

Mode 5 - Snow Removal in Winter: This mode activates when the collector and storage circuit pumps (P1 and P2) are manually switched on in order to melt the snow that has accumulated on the collector.

## II. PERFORMANCE EVALUATION

### INTRODUCTION

The site was unoccupied in February; however, the solar energy system operated continuously during the month. Solar energy satisfied 23 percent of the space heating requirements. The solar energy system provided fossil fuel energy savings of 4.8 million Btu and incurred an electrical energy expense of 0.080 million Btu. A control problem caused intermittent cycling of mode 1 during periods of good insolation; this resulted in mode 1 operation for only 60 percent of the time that potential mode 1 conditions existed during the month. There was no hot water load during February since the water was turned off.

### WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 19.6 million Btu for a daily average of 1501 Btu per square foot. This was above the estimated average daily solar radiation for this geographical area during February of 1279 Btu per square foot for a south-facing plane with a

tilt of 37 degrees to the horizontal. The average ambient temperature during February was 23°F as compared with the long-term average for February of 32°F. The number of heating degree-days for the month (based on a 65°F reference) was 1189, as compared with the long-term average of 916.

## THERMAL PERFORMANCE

System - During February the solar energy system performed somewhat poorer than expected. The expected performance was determined from a modified f-chart analysis using measured weather and subsystem loads as inputs. Solar energy collected was 4.0 million Btu versus an estimated 7.9 million Btu. Solar energy used by the system was estimated by assuming that all energy collected would be applied to the load. Actual solar energy used was 2.9 million Btu. System total solar fraction was 23 percent versus an estimated 64 percent. The poorer performance is attributed to the on/off cycling of mode 1 operation during periods of good insolation. This is discussed further in the "Observations" section below.

Collector - The total incident solar radiation on the collector array for the month of February was 19.6 million Btu. During the period the collector loop was operating, the total insolation amounted to 5.2 million Btu. The total collected solar energy for the month of February was 4.0 million Btu, resulting in a collector array efficiency of 20 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was 4.0 million Btu. Operating energy required by the collector loop was 0.080 million Btu.

Storage - Solar energy delivered to storage was 4.0 million Btu. There were 2.9 million Btu delivered from storage to the space heating subsystem. Energy loss from storage was 1.1 million Btu. This loss represented 28 percent of the energy delivered to storage. The storage efficiency was 71 percent: This is calculated as the ratio of the sum of the energy removed from storage and the change in stored energy, to the energy delivered to storage. The average storage temperature for the month was 98°F.

Space Heating Load - The space heating subsystem consumed 2.9 million Btu of solar energy and 15.8 million Btu of auxiliary fossil fuel energy to satisfy a space heating load of 12.4 million Btu. The solar fraction of this load was 23 percent. The space heating subsystem consumed a total of 0.67 million Btu of operating energy.

## OBSERVATIONS

During the month, the solar energy system cycled on and off in mode 1 during periods of good insolation. As a result of this cycling, approximately 40 percent of the available solar energy was not collected. During periods of good insolation, mode 1 operation averaged 45 minutes, while the quiescent periods (between mode 1 operations) averaged 30 minutes. The grantee must determine the cause of this cycling in order to increase the amount of energy collected and to improve the performance of the solar energy system.

The temperatures in the collector/heat exchanger (HX) loop were analyzed to try to determine the reason that the amount of solar energy delivered to the HX (4.1 million Btu) exceeded the energy collected (4.0 million Btu). Before a collection cycle (mode 1) begins, the fluid in the collector is heated by the sun. When mode 1 begins, this heated "batch" of fluid is delivered to the HX. During the start of a collection cycle, the temperature differences between the collector output (T101) and HX input (T103) and between the HX output (T102) and collector input (T100) fluctuate considerably. However, once a steady-state condition is reached (i.e., after the initially-heated "batch" of fluid has been delivered to the HX), the losses in the plumbing normally cause a temperature drop from T101 to T103 and also from T102 to T100. An analysis of the data received for the month does show a small temperature drop between T101 and T103 during steady-state conditions. However, an average temperature rise is shown from T102 to T100 (0.9°F). It is assumed that this temperature rise is due to an error in one or both temperature sensors. The calibration of the temperature sensors in the collector/HX loop will be checked to determine whether this is the only cause of the solar energy gain from the collector to the HX. Further analysis shows that an error of 1°F in T100 (reading too high) will result in the collected solar energy exceeding the energy delivered to the HX by 0.13 million Btu.

Anomalies in two of the three storage temperature sensors required that the storage temperature be based on the single operating sensor. Since this sensor measures the temperature at the top of the tank, the reported average storage temperature (98°F) is probably higher than the true average storage temperature.

An anomaly caused W401 (furnace air flow) to read zero for the entire month. Therefore, the auxiliary thermal energy supplied to the space heating load for February was derived from the auxiliary fossil fuel used during the month rather than from the mass flow and temperature differences in the space heating subsystem.

## ENERGY SAVINGS

The solar energy system provided a total fossil fuel energy savings of 4.8 million Btu and incurred an electrical energy expense of 0.080 million Btu.

## III. ACTION STATUS

The grantee must resolve the cause of the cyclic operation of mode 1 during good insolation conditions. Boeing must resolve the sensor anomalies and IBM must recalibrate the collector/HX loop sensors on their next site visits. No site visits are currently scheduled at this time.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT SITE SUMMARY

SITE: BOND CONSTRUCTION GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979

SCLAR/1050-79/02

SITE/SYSTEM DESCRIPTION: THE SOLAR ENERGY SYSTEM BOND CONSTRUCTION IS A SINGLE FAMILY DWELLING. THE COLLECTION/HX LOOP USES A PROPYLENE GLYCOL SOLUTION AS AN ENERGY TRANSFER MEDIUM. THE HX/STORAGE LOOP USES WATER FOR ENERGY TRANSFER AND WATER IS THE STORAGE MEDIUM. THE STORAGE TANK PROVIDES SOLAR ENERGY FOR SPACE HEATING AND DHW THROUGH HX LOOPS. A GAS FURNACE PROVIDES AUXILIARY SPACE HEAT AS REQUIRED. AUXILIARY HEAT FOR THE DHW IS SUPPLIED ELECTRICALLY.

### GENERAL SITE DATA:

INCIDENT SOLAR ENERGY 19.556 MILLION BTU  
COLLECTED SOLAR ENERGY 42021 RTU/SQ.FT.  
AVERAGE AMBIENT TEMPERATURE 3.971 MILLION BTU  
AVERAGE BUILDING TEMPERATURE 8533 BTU/SQ.FT.  
ECSS SOLAR CONVERSION EFFICIENCY 23 DEGREES F  
ECSS OPERATING ENERGY 65 DEGREES F  
TOTAL SYSTEM OPERATING ENERGY 0.15 MILLION BTU  
TOTAL ENERGY CONSUMED 0.080 MILLION BTU  
0.748 MILLION BTU  
20.577 MILLION BTU

### SUBSYSTEM SUMMARY:

|                     | HOT WATER | HEATING | COOLING |
|---------------------|-----------|---------|---------|
| LOAD                | 0.000     | 12.404  | N.A.    |
| SOLAR FRACTION USED | 0         | 23      | N.A.    |
| SOLAR ENERGY USED   | 0.000     | 2.890   | N.A.    |
| OPERATING ENERGY    | 0.000     | 0.668   | N.A.    |
| AUX. THERMAL ENERGY | 0.000     | 9.471   | N.A.    |
| AUX. ELECTRIC FUEL  | 0.000     | N.A.    | N.A.    |
| AUX. FOSSIL FUEL    | N.A.      | 15.786  | N.A.    |
| ELECTRICAL SAVINGS  | 0.000     | N.A.    | N.A.    |
| FOSSIL SAVINGS      | N.A.      | 4.817   | N.A.    |

### SYSTEM PERFORMANCE FACTOR:

0.68

\* DENOTES UNAVAILABLE DATA  
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT  
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,  
SCLAR/0004-78/18  
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SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT  
SITE SUMMARY

SITE: BOND CONSTRUCTION, GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979

SOLAR/1050-79/02

SITE/SYSTEM DESCRIPTION: THE SOLAR ENERGY SYSTEM BOND CONSTRUCTION IS A SINGLE FAMILY DWELLING. THE COLLECTION/HX LOOP USES A PROPYLENE GLYCOL SOLUTION AS AN ENERGY TRANSFER MEDIUM. THE HX/STORAGE LOOP USES WATER FOR ENERGY TRANSFER AND WATER IS THE STORAGE MEDIUM. THE STORAGE TANK PROVIDES SOLAR ENERGY FOR SPACE HEATING AND DHW THROUGH HX LOOPS. A GAS FURNACE PROVIDES AUXILIARY SPACE HEAT AS REQUIRED. AUXILIARY HEAT FOR THE DHW IS SUPPLIED ELECTRICALLY.

GENERAL SITE DATA:  
INCIDENT SOLAR ENERGY

COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE  
AVERAGE BUILDING TEMPERATURE  
ECSS SOLAR CONVERSION EFFICIENCY  
ECSS OPERATING ENERGY  
TOTAL SYSTEM OPERATING ENERGY  
TOTAL ENERGY CONSUMED

20.632 GIGA JOULES  
477193 KJ/SQ.M.  
4.189 GIGA JOULES  
96907 KJ/SQ.M.  
-5 DEGREES C  
18 DEGREES C  
0.15 GIGA JOULES  
0.084 GIGA JOULES  
0.789 GIGA JOULES  
21.709 GIGA JOULES

SUBSYSTEM SUMMARY:

LOAD  
SOLAR FRACTION  
SOLAR ENERGY USED  
OPERATING ENERGY  
AUX. THERMAL ENG  
AUX. ELECTRIC FUEL  
AUX. FOSSIL FUEL  
ELECTRICAL SAVINGS  
FOSSIL SAVINGS

HOT WATER  
0.000 C  
0.000  
0.000  
0.000  
0.000  
N.A.  
0.000  
N.A.  
N.A.

HEATING  
13.087  
23  
3.049  
0.705  
9.952  
N.A.  
16.654  
N.A.  
5.082

COOLING  
N.A.  
N.A.  
N.A.  
N.A.  
N.A.  
N.A.  
N.A.  
N.A.  
N.A.

SYSTEM TOTAL  
13.087 GIGA JOULES  
23 PERCENT  
3.049 GIGA JOULES  
0.789 GIGA JOULES  
10.037 GIGA JOULES  
0.000 GIGA JOULES  
16.654 GIGA JOULES  
-0.084 GIGA JOULES  
5.082 GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.68

\* DENOTES UNAVAILABLE DATA  
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT  
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,  
SOLAR/0004-78/18

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: BOND CONSTRUCTION, GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979

SOLAR/1050-79/02

| DAY<br>OF<br>MONTH | INCIDENT<br>SOLAR<br>ENERGY<br>MILLION<br>BTU | AMBIENT<br>TEMP<br>DEG-F | ENERGY<br>TC<br>LOADS<br>MILLION<br>BTU | AUX<br>THERMAL<br>TO ECSS<br>MILLION<br>BTU | ECSS<br>OPERATING<br>ENERGY<br>MILLION<br>BTU | ECSS<br>ENERGY<br>REJECTED<br>MILLION<br>BTU | ECSS SOLAR<br>CONVERSION<br>EFFICIENCY |
|--------------------|-----------------------------------------------|--------------------------|-----------------------------------------|---------------------------------------------|-----------------------------------------------|----------------------------------------------|----------------------------------------|
| 1                  | 0.643                                         | 7                        | 0.133                                   | NOT APPLICABLE                              | 0.003                                         | NOT APPLICABLE                               | 0.207                                  |
| 2                  | 0.613                                         | 24                       | 0.114                                   |                                             | 0.002                                         |                                              | 0.187                                  |
| 3                  | 0.883                                         | 15                       | 0.146                                   |                                             | 0.003                                         |                                              | 0.166                                  |
| 4                  | 0.907                                         | 5                        | 0.188                                   |                                             | 0.003                                         |                                              | 0.207                                  |
| 5                  | 1.033                                         | 8                        | 0.161                                   |                                             | 0.004                                         |                                              | 0.157                                  |
| 6                  | 0.689                                         | 26                       | 0.089                                   |                                             | 0.002                                         |                                              | 0.130                                  |
| 7                  | 0.911                                         | 1                        | 0.167                                   |                                             | 0.003                                         |                                              | 0.184                                  |
| 8                  | 0.651                                         | 8                        | 0.000                                   |                                             | 0.000                                         |                                              | 0.000                                  |
| 9                  | 0.890                                         | 6                        | 0.071                                   |                                             | 0.001                                         |                                              | 0.080                                  |
| 10                 | 0.921                                         | 21                       | 0.137                                   |                                             | 0.005                                         |                                              | 0.149                                  |
| 11                 | 0.775                                         | 34                       | 0.116                                   |                                             | 0.004                                         |                                              | 0.151                                  |
| 12                 | 0.682                                         | 21                       | 0.131                                   |                                             | 0.001                                         |                                              | 0.192                                  |
| 13                 | 0.832                                         | 24                       | 0.119                                   |                                             | 0.003                                         |                                              | 0.143                                  |
| 14                 | 0.143                                         | 37                       | 0.000                                   |                                             | 0.000                                         |                                              | 0.000                                  |
| 15                 | 0.213                                         | 23                       | 0.000                                   |                                             | 0.000                                         |                                              | 0.000                                  |
| 16                 | 0.952                                         | 2                        | 0.104                                   |                                             | 0.001                                         |                                              | 0.110                                  |
| 17                 | 0.216                                         | -8                       | 0.000                                   |                                             | 0.000                                         |                                              | 0.000                                  |
| 18                 | 0.752                                         | 17                       | 0.123                                   |                                             | 0.005                                         |                                              | 0.163                                  |
| 19                 | 0.047                                         | 31                       | 0.116                                   |                                             | 0.005                                         |                                              | 0.111                                  |
| 20                 | 0.190                                         | 37                       | 0.088                                   |                                             | 0.000                                         |                                              | 0.463                                  |
| 21                 | 0.883                                         | 36                       | 0.022                                   |                                             | 0.006                                         |                                              | 0.026                                  |
| 22                 | 0.096                                         | 43                       | 0.136                                   |                                             | 0.000                                         |                                              | 1.413                                  |
| 23                 | 1.007                                         | 31                       | 0.109                                   |                                             | 0.005                                         |                                              | 0.109                                  |
| 24                 | 0.696                                         | 25                       | 0.105                                   |                                             | 0.001                                         |                                              | 0.152                                  |
| 25                 | 1.051                                         | 27                       | 0.147                                   |                                             | 0.004                                         |                                              | 0.140                                  |
| 26                 | 0.913                                         | 21                       | 0.105                                   |                                             | 0.004                                         |                                              | 0.115                                  |
| 27                 | 0.846                                         | 40                       | 0.132                                   |                                             | 0.004                                         |                                              | 0.157                                  |
| 28                 | 0.109                                         | 37                       | 0.120                                   |                                             | 0.000                                         |                                              | 1.099                                  |
| SUM                | 19.556                                        | -                        | 2.890                                   | N.A.                                        | 0.080                                         | N.A.                                         | -                                      |
| AVG                | 0.698                                         | 23                       | 0.103                                   | N.A.                                        | 0.002                                         | N.A.                                         | 0.148                                  |
| NBS ID             | Q001                                          | N113                     |                                         |                                             | Q102                                          |                                              | N111                                   |

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT COLLECTOR ARRAY PERFORMANCE

SITE: BOND CONSTRUCTION, GLADSTONE, MISSOURI SOLAR/1050-79/02  
REPORT PERIOD: FEBRUARY, 1979

| DAY<br>OF<br>MONTH | INCIDENT<br>SOLAR<br>ENERGY<br>MILLION<br>BTU | OPERATIONAL<br>INCIDENT<br>ENERGY<br>MILLION<br>BTU | COLLECTED<br>SOLAR<br>ENERGY<br>MILLION<br>BTU | DAYTIME<br>AMBIENT<br>TEMP<br>DEG F | COLLECTOR<br>ARRAY<br>EFFICIENCY |
|--------------------|-----------------------------------------------|-----------------------------------------------------|------------------------------------------------|-------------------------------------|----------------------------------|
| 1                  | 0.643                                         | 0.188                                               | 0.205                                          | 15                                  | 0.320                            |
| 2                  | 0.613                                         | C.185                                               | C.158                                          | 32                                  | 0.258                            |
| 3                  | 0.883                                         | 0.204                                               | C.152                                          | 19                                  | 0.173                            |
| 4                  | 0.907                                         | 0.234                                               | C.250                                          | 8                                   | 0.276                            |
| 5                  | 1.033                                         | C.320                                               | 0.241                                          | 18                                  | 0.233                            |
| 6                  | 0.689                                         | 0.130                                               | 0.117                                          | 35                                  | 0.171                            |
| 7                  | 0.911                                         | 0.214                                               | 0.203                                          | 10                                  | 0.224                            |
| 8                  | 0.651                                         | 0.013                                               | C.028                                          | 14                                  | 0.044                            |
| 9                  | 0.890                                         | 0.138                                               | 0.089                                          | 13                                  | 0.100                            |
| 10                 | C.921                                         | C.364                                               | C.241                                          | 32                                  | 0.262                            |
| 11                 | 0.775                                         | 0.308                                               | C.201                                          | 42                                  | 0.260                            |
| 12                 | 0.682                                         | 0.110                                               | 0.124                                          | 22                                  | 0.182                            |
| 13                 | 0.832                                         | C.195                                               | 0.173                                          | 30                                  | 0.208                            |
| 14                 | 0.143                                         | 0.000                                               | 0.000                                          | 40                                  | 0.000                            |
| 15                 | 0.213                                         | 0.000                                               | 0.000                                          | 24                                  | 0.000                            |
| 16                 | 0.952                                         | 0.115                                               | C.145                                          | -1                                  | 0.153                            |
| 17                 | 0.216                                         | 0.000                                               | 0.000                                          | 11                                  | 0.000                            |
| 18                 | 0.752                                         | C.375                                               | 0.177                                          | 23                                  | 0.235                            |
| 19                 | 1.047                                         | 0.379                                               | C.290                                          | 41                                  | 0.277                            |
| 20                 | C.190                                         | 0.000                                               | 0.000                                          | 40                                  | 0.000                            |
| 21                 | C.883                                         | 0.447                                               | 0.256                                          | 41                                  | 0.290                            |
| 22                 | 0.096                                         | 0.000                                               | 0.000                                          | 44                                  | 0.000                            |
| 23                 | 1.007                                         | 0.349                                               | 0.249                                          | 32                                  | 0.248                            |
| 24                 | 0.696                                         | 0.054                                               | C.036                                          | 28                                  | 0.052                            |
| 25                 | 1.051                                         | 0.289                                               | 0.241                                          | 33                                  | 0.229                            |
| 26                 | 0.913                                         | C.332                                               | C.191                                          | 41                                  | 0.210                            |
| 27                 | 0.846                                         | 0.277                                               | C.196                                          | 49                                  | 0.232                            |
| 28                 | 0.109                                         | C.000                                               | 0.000                                          | 38                                  | 0.000                            |
| SUM                | 19.556                                        | 5.230                                               | 3.971                                          | -                                   | -                                |
| AVG                | 0.698                                         | 0.186                                               | 0.141                                          | 28                                  | 0.203                            |
| NBSID              | Q001                                          |                                                     | Q100                                           |                                     | N100                             |

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT STORAGE PERFORMANCE

SITE: BOND CONSTRUCTION, GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979 SOLAR/1050-79/02

| DAY<br>OF<br>MONTH | ENERGY<br>TO<br>STORAGE<br>MILLION<br>BTU | ENERGY<br>FROM<br>STORAGE<br>MILLION<br>BTU | CHANGE<br>IN STORED<br>ENERGY<br>MILLION<br>BTU | STORAGE<br>AVERAGE<br>TEMP<br>DEG F | STORAGE<br>EFFICIENCY |
|--------------------|-------------------------------------------|---------------------------------------------|-------------------------------------------------|-------------------------------------|-----------------------|
| 1                  | 0.198                                     | 0.133                                       | -0.011                                          | 96                                  | 0.616                 |
| 2                  | 0.133                                     | C.114                                       | C.000                                           | 96                                  | 0.864                 |
| 3                  | 0.164                                     | 0.146                                       | 0.000                                           | 97                                  | 0.888                 |
| 4                  | C.250                                     | C.188                                       | -0.002                                          | 97                                  | 0.742                 |
| 5                  | 0.233                                     | C.161                                       | 0.001                                           | 98                                  | 0.700                 |
| 6                  | 0.131                                     | 0.089                                       | 0.001                                           | 95                                  | 0.694                 |
| 7                  | 0.215                                     | 0.167                                       | 0.000                                           | C7                                  | 0.775                 |
| 8                  | 0.025                                     | C.000                                       | -0.008                                          | 91                                  | -0.359                |
| 9                  | 0.095                                     | 0.071                                       | 0.005                                           | 93                                  | 0.794                 |
| 10                 | 0.249                                     | C.137                                       | 0.044                                           | 102                                 | 0.729                 |
| 11                 | 0.192                                     | 0.116                                       | 0.017                                           | 103                                 | 0.700                 |
| 12                 | 0.099                                     | 0.131                                       | -0.061                                          | 96                                  | 0.699                 |
| 13                 | 0.187                                     | C.110                                       | -0.008                                          | 98                                  | 0.685                 |
| 14                 | 0.000                                     | 0.000                                       | -0.024                                          | 91                                  | 1.000                 |
| 15                 | 0.000                                     | C.000                                       | -0.016                                          | 89                                  | 1.000                 |
| 16                 | 0.155                                     | C.104                                       | 0.025                                           | 91                                  | 0.835                 |
| 17                 | 0.000                                     | C.000                                       | -0.019                                          | 90                                  | 1.000                 |
| 18                 | C.188                                     | C.123                                       | 0.034                                           | 95                                  | 0.836                 |
| 19                 | 0.283                                     | C.116                                       | C.092                                           | 105                                 | 0.737                 |
| 20                 | C.000                                     | 0.088                                       | -0.113                                          | 94                                  | 1.000                 |
| 21                 | 0.240                                     | C.022                                       | -0.201                                          | 106                                 | 0.899                 |
| 22                 | 0.000                                     | 0.136                                       | -0.192                                          | 101                                 | 1.000                 |
| 23                 | 0.252                                     | C.109                                       | -0.102                                          | 105                                 | 0.841                 |
| 24                 | 0.049                                     | C.105                                       | -0.098                                          | 95                                  | 0.150                 |
| 25                 | 0.264                                     | 0.147                                       | 0.065                                           | 102                                 | 0.804                 |
| 26                 | 0.202                                     | C.105                                       | 0.051                                           | 105                                 | 0.772                 |
| 27                 | 0.209                                     | C.132                                       | C.039                                           | 107                                 | 0.823                 |
| 28                 | C.000                                     | 0.120                                       | -0.164                                          | 97                                  | 1.000                 |
| SUM                | 4.032                                     | 2.890                                       | -0.022                                          | -                                   | -                     |
| AVG                | 0.144                                     | 0.103                                       | C.000                                           | 98                                  | 0.711                 |
| NBS ID             | Q200                                      | Q201                                        | Q202                                            |                                     | N108                  |

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT HCT WATER SUBSYSTEM

SITE: BCND CONSTRUCTION, GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979

SCLAR/1050-79/02

| DAY<br>OF<br>MON. | HOT<br>WATER<br>LOAD<br>MILLION<br>BTU | SOLAR<br>FR. OF<br>LOAD<br>PER. | SOLAR<br>ENERGY<br>USED<br>MILLION<br>BTU | OPER<br>ENERGY<br>MILLION<br>BTU | AUX<br>THERMAL<br>USED<br>MILLION<br>BTU | AUX<br>ELECT<br>FUEL<br>MILLION<br>BTU | AUX<br>FCSIL<br>FUEL<br>MILLION<br>BTU | ELECT<br>ENERGY<br>SAVINGS<br>MILLION<br>BTU | FCSIL<br>ENERGY<br>SAVINGS<br>MILLION<br>BTU | SUP.<br>WAT.<br>TEMP<br>DEG<br>F | HOT<br>WAT.<br>TEMP<br>DEG<br>F | HCT<br>WATER<br>USED<br>GAL |
|-------------------|----------------------------------------|---------------------------------|-------------------------------------------|----------------------------------|------------------------------------------|----------------------------------------|----------------------------------------|----------------------------------------------|----------------------------------------------|----------------------------------|---------------------------------|-----------------------------|
| 1                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 2                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 3                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 4                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 5                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 6                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 7                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 8                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 9                 | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 10                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 11                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 12                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 13                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 14                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 15                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 16                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 17                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 18                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 19                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 20                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 21                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 22                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 23                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 24                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 25                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 26                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 27                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| 28                | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | NOT APPLICABLE                         | 0.000                                        | NOT APPLICABLE                               | 60                               | 140                             | 0                           |
| SUM               | 0.000                                  | -                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | N.A.                                   | 0.000                                        | N.A.                                         | -                                | -                               | 0                           |
| AVG               | 0.000                                  | 0                               | 0.000                                     | 0.000                            | 0.000                                    | 0.000                                  | N.A.                                   | 0.000                                        | N.A.                                         | 60                               | 140                             | 0                           |
| NBS               | Q302                                   | N300                            | Q300                                      | Q303                             | Q301                                     | Q305                                   | Q306                                   | Q311                                         | Q313                                         | N305                             | N307                            | N308                        |

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM  
MONTHLY REPORT  
SPACE HEATING SUBSYSTEM

SITE: BOND CONSTRUCTION, GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979  
SOLAR/1050-79/02

| DAY<br>OF<br>MON. | SPACE<br>HEATING<br>LOAD<br>MILLION<br>BTU | SOLAR<br>FR. OF<br>LOAD<br>PCT | SOLAR<br>ENERGY<br>USED<br>MILLION<br>BTU | OPER<br>ENERGY<br>MILLION<br>BTU | AUX<br>THERMAL<br>USED<br>MILLION<br>BTU | AUX<br>ELECT<br>FUEL<br>MILLION<br>BTU | AUX<br>FOSSIL<br>FUEL<br>MILLION<br>BTU | ELECT<br>ENERGY<br>SAVINGS<br>MILLION<br>BTU | FOSSIL<br>ENERGY<br>SAVINGS<br>MILLION<br>BTU | BLDG<br>TEMP<br>DEG.<br>F | AMB<br>TEMP<br>DEG.<br>F |
|-------------------|--------------------------------------------|--------------------------------|-------------------------------------------|----------------------------------|------------------------------------------|----------------------------------------|-----------------------------------------|----------------------------------------------|-----------------------------------------------|---------------------------|--------------------------|
| 1                 | 0.618                                      | 22                             | 0.133                                     | 0.033                            | 0.485                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 7                        |
| 2                 | 0.459                                      | 25                             | 0.114                                     | 0.025                            | 0.344                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 67                        | 24                       |
| 3                 | 0.482                                      | 30                             | 0.146                                     | 0.027                            | 0.336                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 15                       |
| 4                 | 0.640                                      | 29                             | 0.188                                     | 0.034                            | 0.452                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 65                        | 8                        |
| 5                 | 0.637                                      | 25                             | 0.161                                     | 0.032                            | 0.456                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 26                       |
| 6                 | 0.439                                      | 20                             | 0.089                                     | 0.025                            | 0.349                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 10                       |
| 7                 | 0.588                                      | 28                             | 0.167                                     | 0.031                            | 0.421                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 8                        |
| 8                 | 0.673                                      | 0                              | 0.000                                     | 0.031                            | 0.673                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 65                        | 6                        |
| 9                 | 0.657                                      | 11                             | 0.071                                     | 0.033                            | 0.586                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 67                        | 21                       |
| 10                | 0.408                                      | 34                             | 0.137                                     | 0.023                            | 0.270                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 67                        | 4                        |
| 11                | 0.311                                      | 38                             | 0.116                                     | 0.017                            | 0.194                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 21                       |
| 12                | 0.467                                      | 31                             | 0.131                                     | 0.022                            | 0.336                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 67                        | 4                        |
| 13                | 0.383                                      | 0                              | 0.000                                     | 0.017                            | 0.264                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 67                        | 27                       |
| 14                | 0.342                                      | 0                              | 0.000                                     | 0.024                            | 0.342                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 23                       |
| 15                | 0.490                                      | 14                             | 0.104                                     | 0.033                            | 0.622                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 65                        | 28                       |
| 16                | 0.727                                      | 0                              | 0.000                                     | 0.039                            | 0.693                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 17                       |
| 17                | 0.693                                      | 25                             | 0.123                                     | 0.026                            | 0.375                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 33                       |
| 18                | 0.498                                      | 32                             | 0.116                                     | 0.019                            | 0.251                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 17                       |
| 19                | 0.368                                      | 22                             | 0.088                                     | 0.021                            | 0.304                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 66                        | 33                       |
| 20                | 0.392                                      | 14                             | 0.022                                     | 0.009                            | 0.144                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 67                        | 36                       |
| 21                | 0.167                                      | 71                             | 0.022                                     | 0.012                            | 0.056                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 63                        | 43                       |
| 22                | 0.192                                      | 48                             | 0.136                                     | 0.010                            | 0.117                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 62                        | 31                       |
| 23                | 0.227                                      | 28                             | 0.109                                     | 0.022                            | 0.253                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 62                        | 27                       |
| 24                | 0.382                                      | 41                             | 0.147                                     | 0.019                            | 0.215                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 62                        | 31                       |
| 25                | 0.362                                      | 39                             | 0.105                                     | 0.014                            | 0.167                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 62                        | 40                       |
| 26                | 0.272                                      | 58                             | 0.105                                     | 0.013                            | 0.096                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 65                        | 37                       |
| 27                | 0.229                                      | 42                             | 0.132                                     | 0.016                            | 0.168                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 65                        | 37                       |
| 28                | 0.288                                      | 42                             | 0.120                                     | 0.016                            | 0.168                                    | NOT APPLICABLE                         |                                         | NOT APPLICABLE                               |                                               | 65                        | 37                       |
| SUM               | 12.404                                     | -                              | 2.890                                     | 0.668                            | 9.471                                    | N.A.                                   | 15.786                                  | N.A.                                         | 4.817                                         | -                         | -                        |
| AVG               | 0.443                                      | 23                             | 0.103                                     | 0.023                            | 0.338                                    | N.A.                                   | 0.563                                   | N.A.                                         | 0.172                                         | 65                        | 23                       |
| NBS               | Q402                                       | N400                           | Q400                                      | Q403                             | Q401                                     |                                        | Q410                                    | Q415                                         | Q417                                          | N406                      | N113                     |

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.

# SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

## MONTHLY REPORT ENVIRONMENTAL SUMMARY

SITE: BOND CONSTRUCTION, GLADSTONE, MISSOURI  
REPORT PERIOD: FEBRUARY, 1979

SOLAR/1050-79/02

| DAY<br>OF<br>MONTH | TOTAL<br>INSOLATION<br>BTU/SQ. FT | DIFFUSE<br>INSOLATION<br>BTU/SQ. FT | AMBIENT<br>TEMPERATURE<br>DEG F | DAYTIME<br>AMBIENT<br>TEMP<br>DEG F | RELATIVE<br>HUMIDITY<br>PERCENT | WIND<br>DIRECTION<br>DEGREES | WIND<br>SPEED<br>M.P.H. |
|--------------------|-----------------------------------|-------------------------------------|---------------------------------|-------------------------------------|---------------------------------|------------------------------|-------------------------|
| 1                  | 1382                              | NOT                                 | 7                               | 15                                  | NOT                             | NOT                          | NOT                     |
| 2                  | 1319                              |                                     | 24                              | 32                                  |                                 |                              |                         |
| 3                  | 1898                              |                                     | 15                              | 19                                  |                                 |                              |                         |
| 4                  | 1951                              |                                     | 8                               | 18                                  |                                 |                              |                         |
| 5                  | 2221                              |                                     | 26                              | 35                                  |                                 |                              |                         |
| 6                  | 1482                              |                                     | 10                              | 14                                  |                                 |                              |                         |
| 7                  | 1958                              |                                     | 8                               | 10                                  |                                 |                              |                         |
| 8                  | 1400                              |                                     | 6                               | 13                                  |                                 |                              |                         |
| 9                  | 1913                              |                                     | 21                              | 32                                  |                                 |                              |                         |
| 10                 | 1980                              |                                     | 34                              | 44                                  |                                 |                              |                         |
| 11                 | 1666                              |                                     | 22                              | 44                                  |                                 |                              |                         |
| 12                 | 1467                              |                                     | 21                              | 20                                  |                                 |                              |                         |
| 13                 | 1789                              |                                     | 37                              | 30                                  |                                 |                              |                         |
| 14                 | 308                               |                                     | 23                              | 40                                  |                                 |                              |                         |
| 15                 | 458                               |                                     | 22                              | 24                                  |                                 |                              |                         |
| 16                 | 2047                              |                                     | 8                               | 11                                  |                                 |                              |                         |
| 17                 | 464                               |                                     | 17                              | 13                                  |                                 |                              |                         |
| 18                 | 1617                              |                                     | 31                              | 41                                  |                                 |                              |                         |
| 19                 | 2251                              |                                     | 33                              | 40                                  |                                 |                              |                         |
| 20                 | 409                               |                                     | 36                              | 41                                  |                                 |                              |                         |
| 21                 | 1898                              |                                     | 43                              | 44                                  |                                 |                              |                         |
| 22                 | 2077                              |                                     | 31                              | 32                                  |                                 |                              |                         |
| 23                 | 2164                              |                                     | 27                              | 28                                  |                                 |                              |                         |
| 24                 | 1496                              |                                     | 27                              | 33                                  |                                 |                              |                         |
| 25                 | 2260                              |                                     | 31                              | 41                                  |                                 |                              |                         |
| 26                 | 1962                              |                                     | 40                              | 49                                  |                                 |                              |                         |
| 27                 | 1818                              |                                     | 37                              | 38                                  |                                 |                              |                         |
| 28                 | 235                               |                                     |                                 |                                     |                                 |                              |                         |
| SUM                | 42021                             | N.A.                                | -                               | -                                   | -                               | -                            | -                       |
| AVG                | 1501                              | N.A.                                | 23                              | 28                                  | N.A.                            | N.A.                         | N.A.                    |
| NBS ID             | Q001                              |                                     | N113                            |                                     |                                 | N115                         | N114                    |

\* DENOTES UNAVAILABLE DATA.  
N.A. DENOTES NOT APPLICABLE DATA.









UNIVERSITY OF FLORIDA



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